

REMARKS/ARGUMENTS

Overview of the invention :

The invention discloses a liftoff resist, formed **from a single layer of a single material**, and a method to manufacture it. Conventional photoresist (positive or negative) is first patterned in the conventional way. Then, the top surface (only) is exposed to a beam of ions **whose energy is too low to cause sputtering**. Said ions penetrate a short distance beneath the photoresist surface, forming there a hardened layer. This is followed by exposure to ozone which erodes all exposed photoresist surfaces except the aforementioned hardened layer, causing the latter to overhang the unhardened layer beneath it, thereby rendering it suitable for subsequent use as a liftoff mask.

Reconsideration is requested of the rejection of claims 32, 34 under 35 U.S.C. 102(b), as being anticipated by Yamada et al. in US 4,904,619

The cancellation of claims 32-34 has rendered this rejection moot.

Reconsideration is requested of the rejection of claim 1 under 35 U.S.C. 103, as being unpatentable over Yamada et al. in US 4,904,619 in view of Bloomstein et al. in US 6.833.234.

Examiner's new position is that Yamada teaches everything in our claim 1 except exposing the photoresist to ozone. In our previous rebuttals, the use of ozone for hardening the photoresist was never argued to be novel, so the fact that Bloomstein teaches this particular feature in no way renders our claim 1 unpatentable over Yamada.

In every one of our rebuttals we have pointed out that our claim 1 teaches ion bombardment of a **single** layer of patterned photoresist by ions that harden its surface but are of **sufficiently low energy to not remove any material from said photoresist layer**. This sub-process is a key feature of the present invention.

Examiner continues to reject this argument, asserting that these features are already taught by Yamada and/or He. Despite several requests by us, examiner has not told us where these two references make these teachings.

With regard to Yamada, examiner states "Yamada, in col. 5 lines 1-3, discloses that the photoresist surface is subjected to a sputter ion beam with an RF power of about 20W. This is inaccurate for several reasons:

- 1) Yamada does not use an ion beam since this requires DC power, not RF power.
- 2) A power level of 20W does not determine the energy of the ions so provides no guidance as to whether or not the photoresist would be sputtered, and...
- 3) Yamada explicitly states that his layer of photoresist is sputter etched (col. 5 line 3, 2<sup>nd</sup> and 3<sup>rd</sup> words) so, regardless of the power level, the ion voltage was high enough to cause sputtering.

With regard to He, examiner states "He is depended upon to disclose the claimed ion beam energy of about 100 volts. The claim recites that the ion beam has an energy between about 50 and 200 volts. He teaches the use of ion beam energy at 100 volts which is one of the claimed voltage values. Therefore, employing the claimed energy level suggested by He, will provide the same ion energy as that claimed".

Examiner has not told us just where in He this teaching of 100 volts is to be found. We were unable to find it ourselves by looking through He and, since examiner has still not provided precise col.-line information, we must assume that examiner is

mistaken in this regard. Additionally, claim 4 (which claims 100 volts) has been canceled so is no longer relevant.

We therefore respectfully and particularly request that examiner cite a reference that teaches ion beam bombardment of a single photoresist layer at energies that are too low to cause sputtering, with the intent of forming a liftoff mask, or allow claim 1.

Additionally, examiner has not cited prior art that teaches formation of an overhang (of the same resist material) for the purpose of preventing material (that is later to be subjected to liftoff) from coating the sidewalls of the photoresist (see his FIG. 1b). This step is, however, a key part of our claim 1, as follows:

exposing said photoresist pattern to ozone whereby said sidewalls are eroded and said hardened layer is unchanged so that **the hardened layer overhangs the unhardened layer** (emphasis added).

In the absence of the overhang, it is very difficult to prevent some of the deposited material (in Yamada's case this is layer 16) from ending up on the sidewalls of the photoresist pedestal (element 15 in Yamada). In fact, Yamada's FIG. 1c actually shows some of layer 16 coating the sidewalls of pedestal 15. The consequence of this approach is that Yamada's liftoff step will take much longer than liftoff performed during the exercise of the present invention. For Yamada this is a small price to pay since the goal of his invention is not an improved liftoff process but, rather, a method of protecting the edges of a counter-electrode.

In summary, examiner has yet to cite prior art that uses a single photoresist layer, including an overhanging top portion, for the purposes of liftoff etching. Additionally, examiner has yet to cite prior art that teaches forming said overhanging top portion by first bombarding said top layer by means of an ion beam whose ions have energies that are too low to cause sputtering followed by selectively shrinking the non-bombarded part of the resist, thereby forming the overhang.

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Examiner further states that Yamada is relied upon to teach the use of a single layer resist in a liftoff method. While it is true that Yamada uses a single photoresist layer in a liftoff process it is a different process from that claimed in our claim 1.

Specifically:

Yamada does not form an overhang (of the same resist material) for the purpose of preventing material (that is later to be subjected to liftoff) from coating the sidewalls of the photoresist (see his FIG. 1b). This step is, however, a key part of our claim 1, as follows:

exposing said photoresist pattern to ozone whereby said sidewalls are eroded and said hardened layer is unchanged so that **the hardened layer overhangs the unhardened layer** (emphasis added).

A specific response to this particular argument is respectfully requested.

Reconsideration is requested of the rejection of claims 2, 3, 5-9 under 35 U.S.C. 103:

Applicant asserts that, in light of the foregoing arguments, claim 1 is now allowable, rendering said claims, which are dependent on claim 1, also allowable.

In view of the arguments presented above, applicants respectfully request that a timely Notice of Allowance be issued in this case.

Respectfully submitted,

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